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THE LIFE HISTORY OF EPHEMERA SIMULANS WALKER IN LAKE WAWASEE*.

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INTRODUCTION

Ide (1935) has studied the various instars in the development of the nymph of *Ephemera simulans* Walker, but does not state the length of the life cycle. Neave (1932) decided that in Lake Winnipeg species of *Hexagenia*, a genus very closely related to *Ephemera*, took two years to complete the life history cycle. The length of the life cycle and the rate of development of the species of *Ephemera* have been discussed but never satisfactorily settled. The present paper attempts to answer these questions with respect to *Ephemera simulans* in Lake Wawasee.

METHOD

The data for this paper have been derived from the specimens of *Ephemera simulans* collected during the summers of 1926 and 1927 in connection with a quantitative study of the bottom fauna of Lake Wawasee (see Scott, Hile, and Speith, 1928).

The methods employed in the quantitative study were as follows: From the first of June until August 26, 1926, 113 littoral stations, more or less evenly spaced around the entire periphery of Lake Wawasee, were sampled. These were divided into two series of 58 and 55 each. It is important to note that the stations of the second series were interspersed between those of the first series. At each station samples were taken at depths of 5, .75, 1, and 1.25 meters.

Deep water samples were taken during a corresponding period in 1927. They were made on the odd contours from the 3 meter contour on one side of the lake to the 3 meter contour on the other side of the lake. Twenty such series, totaling 339 individual stations, were taken.

EMERGENCE OF IMAGOES

In Indiana the main emergence of *E. simulans* usually occurs during a relatively short period, during the last of May and the first few days in June. Stragglers, however, precede and follow this by several days. The following dates represent the emergence of huge numbers of individuals, or "swarms" as they are commonly known:

22 May, 1930	Spencer, Indiana
23 May, 1929	Lake Wawasee, Indiana
24 May, 1929	Lake James, Indiana
4 June, 1929	Spencer, Indiana
5 June, 1927	Winona Lake, Indiana

*The author wishes to thank Dr. Will Scott of Indiana University for allowing the removal of the specimens from the general quantitative collection at Indiana University, and also the American Museum of Natural History and especially Dr. F. E. Lutz for having so kindly made available a room in which to conduct research.

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7 June, 1927 ..... Lake Wawasee, Indiana

Unfortunately no emergence dates are available for 1926. There is no reason, however, to suppose that they varied from the average.

The imagoes, having shed their subimago cast sometime during the afternoon, engage in the nuptial flight and mate just at dusk. This, in the case of the lake forms, occurs at the edge of the lake. The females then fly out over the lake and deposit their eggs.

DEVELOPMENT AND DISTRIBUTION OF NYMPHS

Eggs of *Ephemera,* stripped from fertilized females, hatched within 14 days after having been kept in an environment much warmer than the normal one. The eggs of *Hexagenia,* which kept under identical conditions, hatched in 15 days but when they were kept in an environment more nearly like the natural one they took 21 days to hatch. It seems likely that *Ephemera simulans* eggs take from 20 to 30 days to develop in their natural habitat.

Upon hatching, the young nymphs are negatively phototropic and positively thigmotropic, and burrow into the substratum at once.

During 1926 no specimens were found in the samples from the first 64 stations. It should be recalled that 58 stations made up the first series. Thus collections had been made in representative habits around the entire lake and the second series well started before any specimens were found. Specimens of other species of Ephemerida were, however, collected during this period. At station 65, 4 specimens ranging from 3.5 to 4.5 mm., were collected. (See Table 1.) Measurements were made from the front of the head to the posterior tip of the abdomen. It is also well to note that the measurements were made from preserved specimens. Since all specimens were preserved under similar conditions, however, the relative lengths should remain the same.

No specimens of less than 3 mm. were collected. Apparently specimens of smaller size were either too small to be seen or else they were lost in the preparation of the quantitative sample. Specimens of *E. simulans* were found at a majority of the littoral stations from No. 65 to 113 (Table I). The lack of specimens at such stations as 73, 75, 79, and 81 to 88 can be attributed to the type of bottom.

Specimens of *E. simulans* doubtless were present in various stages of development, but too small to be collected, at the time the samples from the stations previous to No. 65 were taken.

The deep water samples taken from the first of June to the last of August in 1927 contained only one specimen of *E. simulans.* Nymphs of *Hexagenia occulta* Walker, the only other burrowing species to be found in the lake, were taken at various times during the summer.

The single deep water specimen of *E. simulans* was collected August 12, 1927, at a depth of 3 meters. It was 6 mm. long. The average length of the specimens collected from littoral stations on August 12, 1926, was 6.63 mm.

A study of the specimens collected from the littoral region show that the growth of *E. simulans* during the summer months is rather rapid. (See Table I.) Thus while the average length was 3.9 mm. on July 19, it was 11.39 mm. on August 26. This represents approximately a three-fold increase in 39 days. The

rate of growth, however, seems to be highly variable. Thus in every sample where 22 or more individuals were collected, the smallest specimen was less than one-half the length of the longest. In many cases the disparity was much greater. All individuals, however, represented early developmental stages.

Table I.
(measurements in millimeters)

Station	Date	Number Spec.	Min. Spec.	Max. Spec.	Average Length
65	7.19.26	4	3.5	4.5	3.9
73	7.21.26	7	3.5	6.	4.3
71	7.22.26	6	3.	5.	3.9
72	7.26.26	1	6.	0	6.
74	7.27.26	64	3.5	8.	5.37
76	7.28.26	1	4.5	0	4.5
78	7.29.26	10	4.	6.	5.2
80	8. 2.26	1	6.	0	6.
88	8.11.26	22	4.	10.5	7.01
89, 90	8.12.26	63	4.	9.	6.63
91	8.13.26	57	5.	10.5	7.5
92, 93	8.14.26	143	5.	11.	7.2
94, 95	8.16.26	69	4.5	12.	8.4
96, 97	8.17.26	199	4.5	11.5	7.9
98, 99	8.18.26	375	5.	15.	8.27
100, 101	8.19.26	111	5.	12.	7.8
103	8.20.26	3	6.	9.5	6.23
104	8.21.26	11	7.	13.	9.0
107, 108	8.23.26	92	5.	13.	9.24
109, 110	8.24.26	444	5.5	15.	9.25
111, 112	8.25.26	313	6.	15.	9.82
113	8.26.26	138	7.	15.	11.39

BIOLOGICAL PRODUCTIVITY

From the standpoint of productivity, *E. simulans* plays an important role in the lake. The nymphs feed upon the organic material that is found in the substratum through which they burrow. How available these nymphs in turn are as food for other animals, particularly fish, is questionable. The nymphs are negatively phototropic and positively thigmotropic, as was noted earlier in this paper. There is no evidence, so far as I know, either from my own experience or that of others, to indicate that they leave their burrow at night. Unless this is so, it seems doubtful if they can be ferreted out by other animals. The one exception is during the emergence period when the nymphs leave the burrows and swim to the surface. At this time fish feed freely on nymphs, subimagoes and imagoes.

SUMMARY

From the data given above a few facts stand out:

1. The emergence of *E. simulans* occurs in Indiana during the last of May and the first few days of June.
2. During the month of June and the first half of July, no specimens of *E. simulans* were collected in either littoral or deep water quantitative samples

taken in Lake Wawasee in 1926 and 1927. It is especially interested to note that no specimens of approximately half grown size were collected.

3. During the last half of July and the greater part of August, 1926, thousands of individuals of *E. simulans* were taken from littoral samples. During a corresponding period a year later, only one specimen, and that at 3 meters, was collected from deep water.
4. The average rate of growth for the littoral specimens was very rapid, being almost three-fold in 39 days. Unquestionably this rate of development does not continue throughout the winter. Murphy (1922) has shown that in *Baetis* the rate of growth and length of the nymphal period depends directly upon the temperature. If this applies also to *E. simulans,* and there seems no reason to doubt it, the rapid growth would continue in Lake Wawasee until the last of September and gradually slow down as the water cools off. Even at that the nymphs probably will have reached almost mature length before the winter arrives.
5. There seems to be some evidence that the burrowing nymphs may not be accessible as food for nekton animals. The greatest exception to this would be at the time of emergence when imagoes and subimagoes, as well as nymphs, are freely eaten.

CONCLUSIONS

From these data concerning the rate of development and the distribution in time and place of the nymphs, it seems obvious that in Lake Wawasee *Ephemera simulans* Walker is a burrowing form that is restricted to the littoral area and takes only one year to complete its life cycle.

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SHORT STUDIES IN THE HISTERIDAE (COLEOP.)—NO. 1.

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It is the purpose of the writer, in this paper, to describe two apparently new species of *Histeridae* and, in addition, to review the American species of the subgenus *Paralister*. The following species is named in honor of Dr. C. H. Seevers, to whom I am indebted for numerous favors.

Isolomalus seeversi n. sp.

Form oval, moderately convex; dark reddish brown, shining; minutely alutaceous throughout, elytra less distinctly so. Head minutely punctulate; marginal stria fine, absent anteriorly, extending midway between pre-ocular and clypeal angles.

Pronotum one-third broader than median length; marginal stria complete; disc sparsely, finely punctate, much more minutely so at sides.

Elytra together nearly as long as broad, at humeri slightly broader than pronotum; sides arcuately converging from basal third to apex; apical width slightly

less than half that at humeri. Punctation a little coarser than on pronotum, the punctures somewhat elongate, rather lightly impressed, becoming exceedingly shallow apically; apical fourth and a very narrow margin along the suture smooth. Subcariniform marginal stria extending around apical angle, from thence obsolete. Epipleura unistriate. Dorsal striae feeble, represented by two to four short, oblique rows of more or less confluent punctures on basal third. Sutural stria absent.

Propygidium sparsely, minutely punctate. Pygidium microscopically, sparsely punctate.

Prosternum without striae, impunctate. Meso- and metasternum minutely, sparsely punctate medially, the punctures becoming elongate and coarser laterad. Marginal stria of mesosternum fine, narrowly interrupted in front.

Anterior tibiae broad, evenly arcuate; apex broadly oblique, straight, with four small, acute, equidistant teeth. Terminal spur long.

Length: 1.5—1.75 mm. Width: 1.15—1.2 mm.

Type; 1 spec., sex undetermined, Auburn, Kansas, XI/1/33.

Paratypes: 2 spec., same data as above.

Type Locality: Auburn, Kansas.

All the specimens were collected by Dr. C. H. Seevers by sifting the humus around dead logs. Types are deposited in the collection of the writer.

This species can easily be separated from the other allied species. In form it resembles *I. seminulum,* from which it may be distinguished by the absence of a sutural stria and by the interrupted marginal stria of the head. From *I. debilis* it can be separated by its more convex, oval form and its narrowly interrupted marginal mesosternal stria, which in *debilis* resembles that of *bistriatus.* Among the North American species of *Isolomalus* the distinctly alutaceous pronotum seems to be a character peculiar to *seeversi.*

Hister aenigmaticus n. sp.

Oblong-ovate, convex; black, shining; sparsely, shallowly punctulate throughout. Head with the frontal stria deeply impressed, complete.

Pronotum twice as broad as long, with the two lateral striae abbreviated, the inner one fourth from base, the outer extending a little beyond the middle.

Elytra together one-fourth broader than long. Four dorsal striae complete, the fifth and sutural subequal, extending a little in front of the middle; the fifth with a basal appendix. Oblique humeral finely impressed; external subhumeral entire, deeply impressed; inner subhumeral represented by a row of fine disconnected punctures extending from tip of oblique humeral to the apex. Epipleura unistriate.

Propygidium coarsely rather sparsely punctate; pygidium a little more finely so, the punctures at apex minute.

Prosternum flattened behind, with two striae, these converging anteriorly, abbreviated a little beyond the middle. Mesosterum feebly emarginate, the marginal stria complete.

Anterior tibiae with six teeth, the apical tooth feebly bifid, the basal two small.

Type: 1 spec., Beverly Shores, Indiana, V/1/35, on dog carrion. Deposited in the collection of the writer.

This species cannot be assigned to any of Horn's group of the genus *Hister*. It possesses characters of both the *merdarius* and *defectus* groups. From the former *aenigmaticus* may be separated by the striate prosternum; the six-dentate anterior tibiae distinguish it from the second.

Subgenus *Paralister* Bickh.*

The subgenus *Paralister* as defined by Bickhardt is restricted to those members of the genus *Hister* which possess a single lateral pronotal stria (which is rather distant from the margin), an outer subhumeral stria only, three to four complete dorsal striae, and an emarginate mesosternum. Although the majority of the species within the group are rather closely allied, the artificiality of the classification (of the genus *Hister* into subgenera) unfortunately demands that several heterogeneous elements be placed in *Paralister,* whlie a few apparently related forms are excluded.

The American components of the group have never been brought together as such. They are here thus incorporated. The following key and descriptions will serve to define the species:

KEY TO THE AMERICAN PARALISTER.

(A) External subhumeral stria complete
  (B) Epipleura unistriate
    (C) Anterior tibiae 5-denticulate ..... *punctiventer* Mars.
    (CC) Anterior tibiae 6-denticulate
      (D) Form rather broadly oval; pronotum within the lateral stria rather coarsely punctate ..... *cognatus* LeC.
      (DD) Form oblong-subparallel; pronotum within the lateral stria more finely punctate ..... *marginicollis* LeC.
  (BB) Epipleura bistriate ..... *remotus* LeC.
(AA) External subhumeral stria abbreviated apically, confined to basal half
    (E) Epipleura unistriate ..... *semisculptus* LeC.
    (EE) Epipleura tristriate
      (F) Anterior tibiae 3-dentate, propygidium and pygidium densely punctate ..... *californicus* Mars.
      (FF) Anterior tibiae 4-dentate, propygidium moderately punctate ..... *litus* Mars.

Hister (Paralister) punctiventer Mars.

Ann. Soc. Ent. Fr., p. 543, pl. 9, fig. 114, (1854).

Rather broadly oval, subconvex, black, shining. Head with the frontal stria subsinuate, complete, deeply impressed.

Pronotum twice as broad as median length, the sides arcuate, rather strongly converging anteriorly; inner lateral stria entire, outer absent; disc finely, sparsely punctulate.

Elytra together two-thirds as long as broad nearly twice as long as, and at humeri distinctly broader than, pronotum. External subhumeral stria complete, deeply impressed; internal absent. Oblique humeral finely impressed. Three dorsal striae entire, the fourth slightly abbreviated at base; fifth extending to, or nearly to, the middle; the sutural somewhat longer, usually extending to basal

*Gen. Insect., Fasic. 166, 1917, pp. 188-9.

third. Epipleura unistriate. Propygidium bifoveolate, coarsely densely punctate; pygidium similarly so.

Prosternum with the lobe margined. Mesosternum feebly emarginate, the marginal stria entire.

Anterior tibiae 5-dentate, the apical tooth bifid. Middle and posterior tibiae biseriately spinulose.

Length; 4.75-5.2 mm. Width; 3.3-3.7 mm.

Mexico. This species and the following represent a rather distinct group in the subgenus, both being of broadly oval form and possessing a complete external subhumeral stria and unstriate epipleura.

Hister (Paralister) cognatus LeC.

Bost. Journ. Nat. Hist., V, p. 28, Pl. 3, fig. 10 (1845) Mars., Ann. Soc. Ent. Fr., p. 421, Pl. 10, fig. 111, (1857); Horn, Proc. Amer. Phil. Soc., XIII, p. 286, (1873).
unicus, Csy., Ann. N.Y. Acad. Sci., VII, p. 547, (1893).
sinuosus Lew., Ann. Mag. Nat. Hist. (7), V, p. 231, (1900).

Rather broadly ovate, black, shining. Head smooth, frontal stria entire, semi-circular, deeply impressed. Pronotum twice as broad as long, sides moderately, arcuately converging anteriorly. Disc shallowly, sparsely punctulate, the punctures within the lateral stria coarse and sometimes in a rather broad area; the tip of the stria somewhat confused with the punctures. Interval between the stria and the margin moderately convex.

Elytra together twice as long as, and at humeri distinctly broader than, pronotum. Punctulation nearly obsolete. Three dorsal striae entire, the fourth varying from abbreviated just before the middle to entire and arching toward the scutellum. Fifth and sutural apical, the sutural usually slightly longer than fifth and extending to middle or slightly beyond. Oblique humeral finely impressed, external subhumeral entire, deeply impressed; internal absent. Epipleura unistriate. Propygidium and pygidium moderately coarsely, rather densely punctate.

Prosternum convex, basally somewhat flattened; lobe sparsely punctate, evenly rounded and occasionally completey margined at apex. Mesosternum feebly, broadly emarginate, marginal stria entire.

Anterior tibiae with six small acute teeth. Middle and posterior tibiae biseriately spinulose.

Length: 3.5-4.5 mm. Width: 2.75-3.5 mm.

The variant described by Casey as *unicus* was that in which the fourth dorsal stria is complete and arching toward the scutellum. This was the only form known to Marseul at the time he redescribed the species in his spendid monograph of the family. Later, however (1861), he briefly described the more typical form in which the fourth dorsal is but slightly shorter than the first three. In two specimens at hand the propygidium and pygidium are very sparsely punctate (*sinuosus* Lew.). Since they present no other appreciable differences, and since punctation is so very variable in the *Histerinae*, it would appear to be very unwise to separate them on this character alone.

Middle States; Illinois, Wisconsin, Michigan, Indiana, New York, Texas, Canada.

This species is allied to the preceding, from which it may be separated by its 6-dentate anterior tibiae and non-crenulate striae. It is very commonly labelled in collections as *marginicollis,* but its oval form will distinguish it from that species.

Hister (Paralister) marginicollis LeC.

Bost. Journ. Nat. Hist.,V, p. 28, pl. 3, fig. 11, (1845).
Mars., Ann. Soc. Ent. Fr., p. 542, pl. 9, fig. 113, (1854).
Horn, Proc. Amer. Phil. Soc., XIII, p. 286, (1873).

Form oblong, subparallel. Head impunctate, frontal stria deep, entire. Pronotum nearly twice as broad as median length. Outer lateral stria absent; inner complete, deeply impressed; disc shallowly punctulate, a few scattered, coarser punctures within the stria.

Elytra together one-fourth broader than long, sides feebly arcuate, subparallel. Outer subhumeral striae complete, deeply impressed, inner absent; oblique humeral finely impressed. Dorsal striae finely impressed, three entire; fourth extending slightly beyond three-fourths to base, fifth confined to apical third, sutural extending to basal third. Propygidium moderately coarsely, not densely punctate. Punctation of the pygidium similar, the punctures becoming minute near the apex.

Prosternum rather feebly convex, lobe finely margined at apex. Mesosternum feebly emarginate, marginal stria entire.

Anterior tibiae 6-dentate, the apical tooth bifid. Middle and posterior tibiae biseriately spinulose.

Length: 3.25-4 mm. Width: 2.5-3 mm.

This and the following species are rather closely allied; *marginicollis* may, however, be separated from *remotus* by its unistriate epipleura. The elder LeConte, when he described *marginicollis,* figured it as being broadly oval; it is not, but rather is oblong-subparallel as figured by Marseul. Its form presents the only really definitive character which can be used to separate it immediately from *cognatus* without referring to comparative material. The attempt to distinguish between the two on the basis of a thickened pronotal margin in one, (as has been done), is futile. The interval between the lateral stria and the margin is somewhat convex in both species; in *marginicollis,* the punctation within the lateral stria of the pronotum is usually finer and of less extent than in *cognatus,* but this character is of little value because of variations in both species.

Distribution: Middle States; Illinois, Indiana (?).

Although it is very probable that *marginicollis* does occur in Indiana, I am inclined to believe that Blatchley's record may have been of *cognatus,* since he refers to the species as "broadly oblong-oval," a descriptive term certainly not applicable to the former but appropriate to the latter; furthermore, he does not record *cognatus,* which is of common occurrence in northern Indiana.

Hister (Paralister) remotus LeC.

Proc. Acad. Nat. Sci. Phila., p. 70, (1859).
Horn, Proc. Amer. Phil. Soc., XIII, p. 286, (1873).

Form oblong-subparallel, subconvex; black, shining. Head with the frontal stria complete, well impressed. Pronotum nearly twice as broad as median length; sides feebly converging anteriorly; outer lateral stria absent; inner com-

plete. Disc with a few punctures within the stria.

Elytra with three entire dorsal striae; fourth slightly abbreviated at base, fifth one-third the length of the elytra, apical; sutural extending to near the middle. External subhumeral stria deeply impressed, complete; inner absent. Oblique humeral finely impressed. Epipleura bistriate. Propygidium sparsely, rather coarsely punctate, the pygidium more densely so.

Prosternum moderately convex; lobe evenly rounded at apex, distinctly margined. Mesosternum feeble emarginate, marginal stria entire.

Anterior tibiae pluridentate. Middle and hind tibiae biseriately spinulose.

Length: 3.5-4 mm. Width: 2.5-2.9 mm.

Distribution: California, Oregon.

Easily distinguished from *marginicollis* by its bistriate epipleura.

Hister (Paralister) semisculptus LeC.

Smiths. Misc. Coll., VI, No. 167, p. 60, (1863).
Horn, Proc. Amer. Phil. Soc., XIII, p. 289, (1873).

Oblong-subparallel, subconvex; black, shining; head with the frontal stria well-impressed, complete. Pronotum nearly twice as broad as long, sides feebly converging anteriorly. Outer lateral stria absent, inner complete, rather distant from the margin. Disc with or without fine, sparse punctulation.

Elytra together not twice as broad as long, at the humeri distinctly broader than the pronotum. Three dorsal striae entire; fourth, fifth, and sutural variable, apical. Internal subhumeral absent; outer basal, represented by a short appendix near the humerus. Oblique humeral finely impressed. Epipleura unistriate. Propygidium and pygidium coarsely, evenly punctate, the latter rather finely so at apex.

Prosternum convex, lobe evenly rounded at apex, margined. Mesosternum feebly emarginate anteriorly, marginal stria entire.

Anterior tibiae 4-dentate, the apical tooth feebly bifid. Middle and posterior tibiae biseriately spinulose.

Length: 4-4.5 mm. Width; 3.2-3.7 mm.

This species is easily separated from the two preceeding, which it resembles, by the abbreviated external subhumeral stria, and in having the fourth dorsal, as well as the fifth and sutural striae, apical. I can find none but Illinois records for *semisculptus*.

Hister (Paralister) californicus Mars.

Ann. Soc. Ent. Fr., p. 544, pl. 9, fig. 115, (1854).

Ovate, subconvex; black, shining. Front very finely punctulate, stria subsinuate, complete, deeply impressed. Pronotum twice as broad as median length, sides evenly arcuate, moderately converging anteriorly. Inner lateral stria complete, outer absent.

Elytra together two thirds as long as broad; twice as broad as, and at humeri distinctly broader than, pronotum. External subhumeral stria abbreviated apically, confined to basal half; internal absent. Oblique humeral finely impressed. Three dorsal striae entire; the fourth usually representated on apical third by a row of confluent punctures; fifth and sutural absent. Epipleura tristriate. Propygidium and pygidium densely, rather coarsely punctate.

Prosternum convex, lobe punctate, margined at apex. Mesosternum emarginate, marginal stria entire; a short stria present within the anterior angles, between the margin and the marginal stria.

Anterior tibiae tridentate, the apical tooth bifid. Middle and posterior tibiae biseriately spinulose.

Length: 5.5-6 mm. Wdth: 4.28-5 mm.

Distribution; California (lower?), Mexico. I can find no records of *californicus* from U. S. California. Since all other available records are Mexican, I suspect that Marseul referred to Lower California.

Hister (Paralister) litus Mars.

Ann. Soc. Ent. Fr., p. 541, pl. 13, fig. 31, (1861).

Rather broadly ovate, subconvex; black, shining. Head finely punctulate; frontal stria entire, deeply impressed. Pronotum twice as broad as long, the sides evenly arcuate, strongly converging anteriorly. Outer lateral stria absent, internal complete. Marginal stria rather deeply impressed near the anterior angles. Disc punctulate along the sides within the lateral stria.

Elytra together two-thirds as long as broad; twice as long as, and near the humeri distinctly broader than, pronotum. External subhumeral stria abbreviated apically, confined to basal half; internal absent; oblique humeral finely impressed. Three dorsal striae entire; fourth, fifth, and sutural at most represented on apical fourth by more or less confluent rows of punctures. Epipleura tristriate. Propygidium and pygidium evenly, not densely, strongly, and somewhat coarsely punctate.

Prosternum convex; lobe punctate, margined at apex. Mesosternum feebly emarginate, marginal stria entire; in addition there is a short stria within the anterior angle between the marginal stria and the margin.

Anterior tibiae 4-dentate, the apical tooth bifid; middle and posterior tibiae biseriately spinulose.

Length: 6.45-7 mm. Width: 4.75-5 mm.

Mexico. This species resembles *californicus* but may be separated from it by the 4-dentate anterior tibiae, its less densely punctate propygidium and pygidium, the presence of rudimentary fifth and sutural striae, and its larger size.

A NEW RACE OF PARNASSIUS SMINTHEUS FROM CALIFORNIA.*

BY J. McDUNNOUGH,
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While working over long series of the various forms of *P. smintheus*, contained partly in the Canadian National Collection and partly loaned for study from various sources, I came across two male specimens, received in exchange several years ago from R. F. Sternitzky of San Francisco, and collected at Castle Lake, Siskiyou Co. Calif., a rather isolated locality at an altitude of about 6000 ft. in the mountains opposite Mt. Shasta to the west, and close to Mt. Bradley. As these specimens showed several unusual characters I at once got in touch with Mr. Sternitzky and other California collectors and was able to secure a good ser-

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

ies for study; these specimens had apparently all been collected by Messrs. L. Martin and W. B. Davis and were recorded by the latter (1932, Bull. S. Calif. Acad. Sci. XXX, 93) under the name of *smintheus* var. *magnus* Wgt. As these additional specimens show in the main the same distinguishing features that had been noted in the original two, I believe that a good race is indicated, and, in spite of the fact that I have been recently rather critical of certain European authors for establishing races of *smintheus* on inadequate characters, I venture to describe it, taking much pleasure in naming it after the enthusiastic collector from whom the specimens were first received.

Parnassius smintheus var. **sternitzkyi** var. nov.

Male. Of the same large size as *magnus* Wgt. (55-65 mm. wing expanse at widest point) but the ground color of a pure chalky white, as in typical *sayii* from Teller Co. Colo. and with none of the creamy shades generally found in *magnus*. From *magnus* it further differs in the depth and extent of the red maculation, the ocelli being large and brilliantly red, either with or without white centres, the post-cellular costal spots being generally strongly red-centred, a feature only occasionally present in *magnus*, and in one case (the holotype) a red pupil occurring in the spot above middle of inner margin. The most characteristic feature and one which separates it at once from both *magnus* and *sayii* is the *broad unicolorous dark (unscaled) marginal band on forewings* extending down

P. smintheus var. *sternitzkyi* var. nov. Allotype ♀ and Holotype ♂.

to vein Cu_1 and containing none of the whitish triangular marks along the outer margin found to a greater or less extent in both the other races. The submarginal band is also broad, extending to vein Cu_2 and strongly lunate in character; in consequence the white area between the two dark bands is reduced in size, the inner edge of same being markedly scalloped. The fringes are only faintly checkered, the black dots at ends of veins being quite improminent. On the hind wings the submarginal dark lunules are present to a greater or less extent and there are frequently two small anal spots although this feature, as well as the presence of a dark spot above middle of inner margin of primaries, is not constant; the dark suffusion in basal area of wing is hardly so extended as in normal *magnus*.

Female. Shows the same characters as the male but in this sex the distinction from the allied races is not so marked and the appearance is very much that

of a female *sayii* with possibly a slight increase in the width of the marginal dark areas and a less checkered appearance in the fringes. The red maculation is very brilliant and at times greatly extended in the postcellular and anal spots.

Holotype—♂, Castle Lake, Siskiyou Co. Calif. (July 17, 1931); No. 4116 in the Canadian National Collection, Ottawa.

Allotype—♀, same data (July 19). In the Canadian National Collection through the courtesy of Dr. J. Comstock.

Paratypes—4♂, 3♀, same locality (July 17, 19, 1931) in the Canadian National Collection; 3♂, 3♀, same data, in Sternitzky Collection; 5♂, 5♀, same locality, July 19, 22, in the collection of Dr. J. Comstock.

It is very evidently this race which is recorded by James Behrens from the identical localities as *smintheus* (1882, Papilio II, 50) and listed by Skinner in his Synonymic Catalogue as *sayii*.

As is usual a certain amount of individual variation occurs and the presence or absence of black anal spots in the male has already been commented on. Out of fifteen males examined only three showed a lack of the red filling in the post-cellular spots on primaries, which is practically the reverse of what is found in *magnus* Wgt.; these three specimens have not been included in the paratype series although they show the same broad marginal areas of dark color.

THE BEES OF ALBERTA.—I.

BY T. D. A. COCKERELL,
University of Colorado, Boulder, Colo.

It is proposed to offer a series of papers, based primarily on the material collected by Professor E. H. Strickland of the University of Alberta at Edmonton.

Chelynia nitida (Cresson). This genus of parasitic bees has over twenty species in North America, the majority from the Pacific Coast region. There are two closely allied species described from females, black with cream-coloured abdominal bands. For some years I have had in my collection a male from Tolland, Colorado, July 1915, at flowers of *Frasera*, collected by L. A. Kenoyer, determined by me as *C. nitida* (Cress). I now receive a very similar but distinct male from Professor E. H. Strickland, collected by O. Peck at Beaverlodge, Alberta, July 6, 1931. I conclude that this must be the genuine *C. nitida*, and the Tolland one the undescribed male of the related *C. idahoensis* Swenk. They are separated thus:

Larger and more robust, anterior wing a little over 7 mm.; face broad; bands on third and fourth tergites broadly incised at sides posteriorly, on fifth reduced to two transverse marks on disc; apical part of abdomen with much long black hair ..... *idahoensis.*

Considerably smaller and less robust, anterior wing 6.4 mm.; face narrower below; five well developed abdominal bands, the first narrowly interrupted, none evidently incised sublaterally behind; long hair on apical part of abdomen pale ..... *nitida.*

In *C. idahoensis* the second, third and fourth sternites have regular reddish fringes, that on the fourth abruptly interrupted in middle, where the sternite is emarginate; the third sternite has a little shining tubercle in middle.

In *C. nitida* there is also a shining tubercle, rather differently formed, more transverse; and the fringe on second sternite is white.

Chelymia interrupta (Cresson). Described in 1879 as *Stelis interrupta,* from a single female taken by Morrison in Nevada. I refer here a female from Lethbridge, June 12, 1933, although it has a good deal of coarse black hair mixed with the light on face, and coarse black hair on lower part of pleura.

Anthidium tenuiflorae Cockerell. Medicine Hat, June 16, 1926 (F. S. Carr), one male. Professor Strickland also sends a female of *A. tenuiflorae yukonense* Cockerell, 1926, from Hay River, N.W.T., June 23, 1927 (H. Bedford). I notice that in this form the abdomen is broader than in tyipcal *A. tenuiflorae.* It will be of interest to collect these bees in Northwest Canada, and see where the two forms meet, and how they intergrade.

Osmia mandibularis Cresson. Delia, July 22, one female (E. H. Strickland). Described in 1878 from Colorado, but Miss Sandhouse (1925) has recorded it from Lethbridge and Medicine Hat.

Osmia pentstemonis Cockerell. Nordegg, July 21, 1926 (E. H. Strickland). Described from Florissant in the mountains of Colorado, but recorded by Miss Sandhouse from Banff.

Osmia chlorops Cockerell. Fawcett, June 20, 1932 (E. H. Strickland), male. Described from northern New Mexico, but it will very likely prove to be the male of the widely distributed *O. densa* Cresson. A female *O. densa* comes from Beaverlodge, July 14, (Strickland).

Osmia atriventris Cresson. Beaverlodge, May 31 (O. Peck); Fawcett, June 10 (Strickland). Females. The white hair on head and thorax is longer and thicker than I have seen it in specimens from elsewhere. The species has been recorded from Saskatchewan; the type came from Connecticut.

Andrena stricklandi sp. n.

A species of *Trachandrena,* very close to *A. mariae* Robertson, but differing thus: the shining white facial foveae somewhat narrower; mesothorax anteriorly entirely dull, appearing granular under a lens, but the posterior half moderately shining, with very large well separated punctures which run more or less in rows; area of metathorax appearing very rough and dull, with the plicae denser and finer; stigma longer and yellower, nervures paler (the basal nervure meets intercubitus); disc of first tergite impunctate, as seen under lens; second tergite in middle depressed less than one half, but a trifle over one-half to subbasal channel; no patches of white pubescence at sides of tergites.

Length about 9 mm.; black, with the broad abdomen bright ferruginous, blackened at tip, the apical tergite pale brown, but overlapped by a fringe of long white hairs; clypeus very densely punctured, but shining between the punctures, with no ridge or smooth line; antennae black, the flagellum red beneath on last three joints; head and thorax with long erect white hair; wings faintly reddish; legs black, only the small joints of tarsi becoming rufescent; hair of hind tibiae shining white, on inner side of hind basitarsi pale chocolate. Third antennal joint not longer than next two together; a shining space between foveae and eye at level of antennae, but it fails above.

Alberta: Gull Lake (Canadian Zone), June 8, 1929 (E. H. Strickland). The type is No. 4167 in the Canadian National Collection.

Clisodon furcatus terminalis (Cresson). Delia, July 22, male (Strickland); Edmonton, June 7—July 22 (Strickland); Fawcett, June 10-20, males (Strickland); Slave Lake, Aug. 16, 1924 (O. Bryant); Gull Lake, July 30, male (Strickland); Nordegg, July 21 (Strickland); Beaverlodge, June 21—July 19 (Strickland); Wabamun, July 10 (Strickland); Red Deer, July 22 (Strickland).

The genus *Clisodon* Patton, 1879, is a segregate from *Anthophora*. It appears to me to be valid, but the European representative is always called *Anthophora furcata* Panzer. The American insect (going east to Maine and Massachusetts) is not more than a race of *C. furcatus* and, in fact, I found the specimens from the Maritime Province of Siberia were best referred to *C. furcatus terminalis*. Some segregates have been named *C. terminalis neofurcatus* Sladen, 1919 (from British Columbia, the female larger) and *C. syringae* Cockerell, 1898 (from Washington and California), while Mr. Timberlake writes me that *Anthophora pernigra* Cresson appears to be a melanic *Clisodon*. In Europe *C. furcatus norvegicus* (Nylander) occurs in Norway and Lapland. *C. furcatus caucasicus* (Friese) is from the Caucasus.

In 1929 Hedicke named *C. furcatus caucasicola*, from the Caucasus, Turkestan and the region of Lake Baikal, and added a female form *atrata* Hedicke.

For a discussion of melanism in this genus see Pan-Pacific Entomologist, Vol. I (1924) p. 50.

Anthophora bomboides Kirby. The species was originally based on the male. A series of species or races can be separated in that sex as follows:

Abdomen with first tergite and base of second with lemon yellow hair (Ontario) ..... *canadensis* Cresson.

Abdomen with first two tergites clothed with reddish ochreous or pale hair .... 1.

Abdomen with first three tergites clothed with pale hair ..... *bomboides* Kirby.

Abdomen with first three tergites and most of fourth clothed with red hair (New Mexico) ..... *neomexicana* Cockerell.

1. Lateral marks filling space between clypeus and eye (Nevada) ..... *sodalis* Cresson.

Lateral marks reduced to narrow stripes contiguous with the black marks at sides of clypeus (Prince Albert, Sask.) ..... *willingi* Cockerell.

All these have the hind basitarsus with a great tooth on the inner side somewhat before the middle. A related Asiatic species is *A. hanseni* Morawitz, found near Irkutsk in Siberia.

Two male *A. bomboides* from Edmonton, sent by Professor Strickland, are strikingly different, but both have the first three tergites with very pale, ochreous-tinted, hair, and those beyond with black. One, taken July 3, is larger and more robust, with no trace of black hair on thorax above; scape broadly yellow in front; supraclypeal band divided in middle; clypeus light yellow except the linear lower margin and a small spot at each side near top; lateral face-marks forming broad bands adjacent to clypeus, and with a linear extension a short way up orbits.

The other, taken June 16, has a little tuft of black hair in the region between mesothorax and scutellum; scape all black; supraclypeal mark small, divided;

clypeus with an elongated black mark on each side; lateral face-marks reduced to narrow bands along clypeus, hardly wider than the black marks.

The June specimen has the clypeal and lateral marks of *A. bomboides willingi,* and probably should be referred to that race, although there are some discrepancies.

Cresson (1869) briefly describes the female *A. bomboides,* stating that "the pubescence of the head, except a slight mixture of pale hairs, and also a spot on the disc of the thorax, is black; the first and second abdominal segments always, and sometimes more or less of the third segment, are clothed with short ochraceous pubescence; the remainder is black or brownish." I have before me eight females from Alberta, and all have the pale ochreous hair covering the first three tergites, contrasting with specimens from Solon Springs, Douglas County, Wisconsin, and Westlake, Colorado, in which this hair covers only the first two tergites. A female from Sioux County, Nebraska, has the first three tergites covered with ochreous hair, except that there is a patch at each extreme side of the third. This specimen has no patch of black hair on the thorax above, and in one from Edmonton, June 29 (Strickland) there is hardly any evidence of the patch; but the other Alberta specimens have the black patch distinct, but variable. These come from Edmonton, June (Strickland); Beaverlodge, July 19 (O. Peck and Strickland) and July 31 (O. Peck). Cresson, when writing his paper of 1869, had before him specimens of *A. bomboides* from Massachusetts, Connecticut, Pennsylvania and West Virginia.

The *A. sodalis* form extends into Oregon (Pan-Pacific Entom., 1924, p. 51), and *neomexicana* is common in the mountains of New Mexico and Colorado, the males varying to a condition in which the red hair covers three tergites, but there is none on the fourth. The lateral face-marks fill the space between clypeus and eye.

A. bomboides is thus modified to form several races or subspecies, but at present these are imperfectly known, and it is much to be desired that studies should be made to determine the variation within a single colony.

Monumetha albifrons (Kirby.) Edmonton, June and July (Strickland); Beaverlodge, June and July (Strickland); Fawcett, June 10 (Strickland). Cresson described it under three names: *M. borealis, M. argentifrons* and *M. obsoleta.* Titus calls attention to the short slender spines on hind margins of first two sternites of the male. In Europe, this species would be placed in *Osmia,* and the structure of the end of the male abdomen resembles that of *O. villosa* (Schenck), an Alpine species of Central Europe.

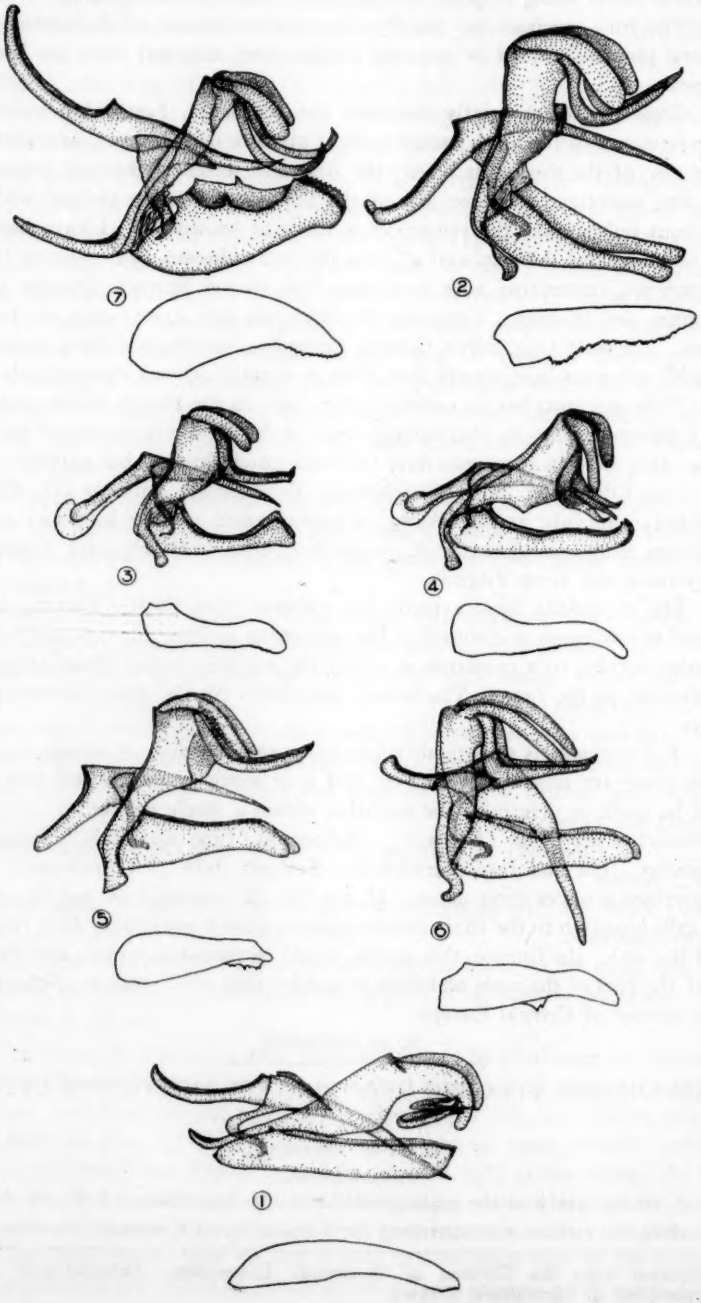
(to be continued)

NOTES ON THE SPECIFIC GROUPING OF THE GENUS LYCAENA (LEPIDOPTERA)*.

BY T. N. FREEMAN,
Ottawa, Ont.

A recent study of the male genitalia of the Lycaenidae of North America, made while the author was attending the University of Colorado, Boulder, Colo.,

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.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showed several interesting points, especially within the subfamily Lycaeninae or "Coppers."

The genitalia of the genus *Lycaena* (Henming, "Generic Names of Holoarctic Butterflies," Vol. 1, 1934) may be divided into five groups, each having characteristics which are not common to any other group. Within the fourth group it will be noted that I have placed the species listed as *Tharsalea hermes* Edw. Fig. 5, the genitalia of which are distinctly Lycaenid in structure and not typical of the other members of *Tharsalea*. I have figured *T. arota* Bdv. Fig. 1, to show this entirely different structure, and if the genitalia show generic relationships, then *T. hermes* Edw. distinctly belongs to the genus *Lycaena* and I propose that its position be changed.

1. *gorgon* group. Fig. 2.
   Harpes long, rather narrow, tapering to apex; inner margins strongly serrate. Aedeagus long, only slightly thickened posterior to basal orifice. Saccus long, extending obliquely downward and backward. Lateral cheeks long and rather broad. Falces curving downward and upward, not angled. The species included are: *heteronea* Bdv., *gorgon* Bdv. and *thoe* Bdv.

2. *dorcas* group. Fig. 3.
   Harpes long, narrow at middle; apices slightly expanded, inner margins serrate. Aedeagus shorter, not noticeably thickened posterior to basal orifice. Saccus long, extending obliquely downward and backward. Lateral cheeks rather short. Falces variable in their curvature. The species included are: *mariposa* Reak., *helloides* Bdv. and *dorcas* Kirby.

3. *epixanthe* group. Fig. 4.
   Harpes long, narrow, apices curved upward; inner margins serrate before their middles. Base of aedeagus only very slightly bent downward. The species included are: *nivalis* Bdv. and *epixanthe* Bdv.

4. *xanthoides* group. Fig. 6.
   Harpes broad; wider at base. Aedeagus much thickened posterior to the basal orifice. Saccus very short, directed forward. Lateral cheeks long and narrow. Falces rather abruptly angled backward before their middles. The species included are: *hermes* Edw., *xanthoides* Bdv., *dione* Mead., *rubidus* Edw. and *editha* Mead.

5. *snowi* group. Fig 7.
   Harpes greatly developed, broad. Base of aedeagus curved upward. Saccus long, narrow, extending forward and upward. Lobes of fulcrum much expanded. Species included are: *hypophleas* Bdv., *cupreus* Edw. and *snowi* Edw.

EXPLANATION OF PLATE

Male genitalia of 1. *T. arota* Bdv. 2. *L. gorgon* Bdv. 3. *L. dorcas* Kirby. 4. *L. epixanthe* Bdv. 5 *L. hermes* Edw 6. *L. xanthoides* Bdv. 7. *L. snowi* Edw. (Each drawing is accompanied by a ventral outline of the left harpe.)

A NEW TEXAS SCARAB (COLEOPTERA).

BY LAWRENCE W. SAYLOR,
University of California.

In working over my *Phyllophaga* of the *lanceolata*-group recently, the present new species was found; although very distinct from *lanceolata* the following nevertheless resembles it so markedly at a casual glance that it is difficult to pick it out in a series.

Phyllophaga (Tostegoptera) squamipilosa n. sp.

Oblong-oval, head and thorax rufopiceous, elytra and legs rufous, scales and vestiture white or creamish-white. Head with front convex, closely, coarsely, rugosely punctured, with long erect *hair;* clypeus broad, apex sharply reflexed, center subtruncate, not sinuate, angles broadly rounded, surface moderately densely punctured, with short erect hair. Antennae rufous, ten-segmented, club one-sixth longer than funicle. Thorax not obviously dilated at sides but widest at anterior third, margin crenate, ciliate, front angles broadly rounded, hind angles rectangular; disc with a rather broad longitudinal impunctate shining vitta running from base to apical third; surface otherwise moderately densely, variolately punctured, the punctures however usually separated by once their diameters and thus not contiguous; surface of thorax with very long fine procumbent hairs, with a few narrow scales along the basal margin. Scutellum with short suberect hairs. Elytra apparently with three smooth vittate areas, surface wrinkled, clothed with rather long narrow white scales, the latter from 5 to 15 times as long as wide, those at apex somewhat shorter and broader. Pygidium sparsely clothed with moderately long, narrow white scales. Abdomen without any trace of tubercles at center, moderately densely clothed with narrow white scale-like hairs, much sparser at center; fifth segment transversely depressed, polished, with a few fine punctures, and several very fine short hairs at center, center of apex very slightly, quite shallowly, arcuately emarginate; sixth segment slightly shorter than fifth, flattened, sparsely punctured with several short hairs, apex ciliate on each side of middle. Hind tibial spurs narrow, acute, one ¾ length of other. Claws with upper tooth small, acute, situated near base. Hind femora densely clothed with very long fine hair. Length 14 mm. Width 7.5 mm.

The unique male type is from Texas, and was given me some time ago by Mr. M. A. Cazier. While closely related to *lanceolata,* it is quite different in the hairy, and not squamous, thorax and head, the non-tubercular male abdomen, hairy hind femora, and in the fact that the lateral thoracic margins are not dilated at about the middle as in *lanceolata* but are widest in the anterior third. The genitalia are not appreciably different.

NOTES ON THE OVIPOSITION AND LIFE HISTORY OF PHLEPSIUS DECORUS O. & B. (CICADELLIDAE).

BY RALPH B. SWAIN,
Colorado State College, Fort Collins, Colorado.

The writer is not aware that observations on the exceedingly interesting oviposition habits of *Phlepsius decorus* O. & B. have ever been published. A

single female of this species was captured on a sunflower plant at Webster Groves, Mo., June 30, 1933. It was placed in a celluloid, cylinder cage enclosing the terminal bud and young leaves of a half-grown sunflower plant where it began feeding at once.

On the morning of July 5, a short line of tiny white, inverted cones was noted on the main stem of the enclosed plant. Two days later, more of the structures appeared on the underside of a leaf petiole. This petiole was removed and examined. The cones, previously noted, averaged three millimeters in height and one millimeter in basal breadth. They tapered gradually and were somewhat rounded at the tips, terminating in a short thread-like process. Each core was hollow, the walls appearing to be made of some frothy substance which had dried to a beautiful, many-faceted film.

Every cone capped an egg inserted into the plant tissue at a slight angle. The narrow end of the egg, the end containing the head of the embryo, was uppermost. Eggs were laid almost every day up to July 21, when the female was found dead. Altogether, one hundred and three eggs were laid by this individual, all of them, except possibly the last twenty, apparently fertile. Eggs were laid only on the main stem and all surfaces of the leaf petioles. Generally, ten or a dozen were laid in a single straight row, fairly close together, but occasionally they were much scattered.

The first eggs hatched July 15, ten days after oviposition. A few eggs from the same egg scar did not hatch until two days later. A first stadium nymph was 1.39 millimeters long and 0.48 millimeters wide across the compound eyes. The eyes were reddish-brown, the body color bluish-gray, mottled with black. The antennae were as long as the body. The hinder part of the abdomen, which was held erect, was set with numerous long, white, conspicuous spines. Four of these were at the dorso-lateral and ventro-lateral corners of the anal segment.

First stadium nymphs were not caged and reared separately, but almost daily observations were made on a mass cage containing eggs laid between July 5 and July 15. There were definitely five stadia. Second instars were seen July 28, third instars, August 2, fourth instars, August 14. All living nymphs were fifth instars by August 20. On August 26, all were adult or fifth instars. Thus under nearly normal conditions the minimum time from egg to adult would appear to be fifty-two days.

The reared adults remained alive and feeding in an outdoor cage on sunflower until November 6. After that date the survivors were placed in a box without food in an unheated room. None lived through the winter under those conditions, but it is fairly evident that normally the adults would overwinter, probably under leaves or in grass clumps, like many other cicadelids.

The writer is indebted to Mr. A. F. Satterthwait, of the United States Bureau of Entomology, for laboratory space at the field station in Webster Groves, Mo.

TWO NEW BEES FROM HAY RIVER.

BY T. D. A. COCKERELL,
Boulder, Colo.

Looking at the map, I have often wondered what bees might be found in those great northern regions of Alberta and Saskatchewan, from which few collections have been seen. Professor E. H. Strickland has sent me numerous species of *Andrena* from the region about Edmonton and thence southwest to Lethbridge. But he has also included two species obtained in the far north, in a latitude about the same as that of the southern tip of Greenland. They are quite different from the more southern species, and so far as I can see, they have not been described. It would thus appear that there is a distinctive northern *Andrena* fauna, probably of few species.

Andrena subarctica n. sp.

♀. Length about 10 mm., anterior wing 8.3; black, head and thorax dull, abdomen shining; hair of head, thorax and first tergite long and white; facial foveae dark chocolate, very broad above, rapidly narrowing below, ending about level with antennae, and there hardly half as far from orbits as from antennae; facial quadrangle broader than long; malar space short but evidently shining; mandibles black, the inner tooth almost obsolete; process of labrum broadly rounded; red hairs from below labrum; clypeus dull, very minutely and weakly punctured, with an evident slender shining median ridge; front entirely dull; cheeks shining behind eyes; antennae black, third joint somewhat longer than the next two together; mesothorax and scutellum entirely dull, the punctures excessively minute, on a microscopically pitted surface; area of metathorax without evident sculpture, slightly shining apically; sides of metathorax with very long curled white hairs; tegulae dark brown; wings reddish hyaline; stigma dull red, rather slender; nervures dusky red; basal nervure falling short of nervulus; second cubital cell very broad, receiving recurrent nervure much beyond middle; legs black, with mostly white hair, hind tibial scopa simple; hind femora with long white hair, but knee-tuft pale chocolate; hind tarsi with white hair, except a broad band of pale chocolate along hind margin; hind tarsi with hair creamy-white on outer side, fulvescent on inner; tergites with broad apical dark red tegumentary bands in the depressions; no evident punctures as seen under a lens; second tergite in middle depressed much less than half; no hair-bands; caudal tuft chocolate.

Hay River, 59° 40', June 5, 1927 (R. H. Bedford.) The abdomen is like that of *A. dunningi* Ckll., but the clypeus is totally different. The locality is very near the northern boundary of Alberta, but in that province.

Andrena hirsutula n. sp.

♀. Length about 7.7 mm., anterior wing 6.5; black, with oval abdomen; head and thorax with long dull white hair; no black hair at sides of face; head ordinary, not very large, facial quadrangle a little broader than long; malar space very short but evident; mandibles stout, slightly reddened at apex, the inner tooth small but distinct; process of labrum shining, broadly rounded, prominent; clypeus shining on disc, with a smooth line, and strong punctures; facial foveae red, narrow, largely hidden by hair, separated from orbits by a shining

line; antennae short, black, third joint about as long as the next two together but these short, broader than long; vertex entirely dull; cheeks very hairy; mesothorax and scutellum dull, median groove of mesothorax distinct; metathorax dull, the area hardly defined, but there is a small shining spot above the truncation; tegulae small, shining, very dark reddish; wings dusky hyaline, iridescent; stigma of moderate size, acutely pointed, dull red; nervures pale reddish; basal nervure falling a little short of nervulus; second cubital cell contracted above, receiving recurrent nervure in middle; legs black with pale hair, slightly yellowish on inner side of hind tarsi; hind tibial scopa large (full of lemon yellow pollen), the hair mainly white, but black on the knee and a short distance below, the long pale hairs plumose; abdomen broad, shining, without distinct punctures, margins of tergites narrowly pallid; second tergite in middle depressed about or nearly one half; disc of first tergite not hairy; tergites with thin bands of long dull white hair, on first and second interrupted in middle; caudal tuft pale chocolate. Claws strongly bidentate.

Hay River, N.WT. May 15, 1927 (R. H. Bedford). This is a species of the subgenus *Pterandrena* Robertson. In Robertson's table it runs near *A. kringiana* Rob., which has a broader head, reddish flagellum and brownish abdomen. It is very like *A. pallidiscopa* Viereck, but smaller, with much paler, pointed stigma. *A. clypeonitens* Ckll. is also allied. The facial foveae are similar in all these species.

The types of these species will be placed in the Canadian National Collection.

A MIGRATION OF THE DRAGONFLY, LIBELLULA QUADRIMACULATA L.

BY R. D. BIRD AND DONALD DENNING,

Brandon, Manitoba.

Libellula quadrimaculata L. is a holarctic dragonfly which exhibits gregarious and migratory behavior. "Immense swarms of this species have been recorded in different parts of Europe on many occasions" (Tillyard)[1] but such flights have not often been recorded in North America. On June 26 a large flight was observed by R. D. Bird at Brandon, Manitoba in a residential district at the south end of town. The location is thickly planted with Manitoba maple trees which reach a height of thirty to thirty-five feet. To the west and south are several sloughs where the dragonflies might have bred but none of them are within a mile and most of them considerably farther. The day was hot and sultry with a maximum temperature of 85°. A violent thunder storm accompanied by hail passed just to the south in the evening. There was a light west breeze. The flight was first seen at 6.00 p.m. but might have been occurring for some time previous. Twenty to thirty dragonflies could be seen at one time between the openings of the trees. They all flew in an easterly direction and most of them at the height of the tree tops but some of them low enough to be caught with a net. The flight continued until it was quite dusk at 9.30 p.m. As darkness grew, more and more dragonflies would settle on the tree tops and bushes. Dead branches were gener-

[1]The Biology of Dragonflies. Cambridge University Press, 1917.

ally preferred. As many as sixty were counted on a single branch of about three feet in length. The insects were quite restless and would leave their perch in a group so that the flight became spasmodic and over a hundred could be seen flying at times. When it got quite dark the dragonflies seemed to disappear and none could be seen on the dead branches against the sky line. None were seen next morning.

It is of particular interest that another flight of *Libellula quadrimaculata* was observed on the morning of the same day by Donald Denning three miles south and three miles west of Orleans, Minnesota. Here the weather was partly cloudy with a slight northeast wind. The dragonflies were all flying in a south-easterly direction. They were first observed at 9.30 a.m. and were still flying in the same direction at 1.00 p.m. In driving north three miles they were encountered over the whole distance. The majority flew at a height of five to six feet, a few up to twenty feet. Less than half a dozen were observed to alight. In ten minutes about one hundred individuals passed over. The entire flight was made up of the same species.

RESEARCH NOTES.

THE DISTRIBUTION OF THE BLACK WIDOW SPIDER IN ALBERTA.

Interest in the possible occurrence of the Black Widow Spider (*Latrodectus mactans*) in Alberta was first aroused by the report, in 1933, that this spider had been taken in Montana.

In 1934, a specimen was submitted to the University from Medicine Hat for determination and, during the same year, some press publicity was given, by the Dominion Entomological Laboratory at Lethbridge, to its occurrence in moderately large numbers in the extreme southern part of the province. Probably as a result of this publicity, an unusually large number of spiders were sent to the University for determination, during that and the following year.

Among them were several Black Widow Spiders from the south-eastern part of the province to as far north as Bassano, where a specimen was found on the irrigation dam across the Bow River. Several others had been taken from places between Bassano and Empress but all of these places were to the south of the Red Deer River. Although many spiders were sent from further north and west none of these was the Black Widow. The majority were Lycosids.

This year has slightly increased their recorded range to the north. In the neighbourhood of Wardlow and Cessford, about eight miles north of the Red Deer River in the centre of the province, section men, working on the railroad, discovered that this spider was common on the right-of-way. They claim that they can pour water between the ends of all adjacent rail lengths, for a distance of about 1½ miles, and on every occasion cause the emergence of from one to three of these spiders. There was no question as to the identity of the specimens which were submitted to the University for identification. They state, also, that the spiders are abundant, also, under discarded ties, and that the men whose duty it is to collect and to burn these are in constant fear of being bitten. Up to the present time, however, no case of attack from this source has been reported.

From these records, it is obvious that the Black Widow Spider inhabits a

large area in south-eastern Alberta, even though its presence in the province has been recognized only within the last three years. The question naturally arises as to whether this is a recent invasion or whether this spider is native to Alberta.

The late Mr. F. S. Carr, who was an indefatigable collector of insects and their relatives, found both white ants and scorpions, while we have captured representatives of the essentially tropical Archnid family Solpugidae, in the river bottoms near Medicine Hat. These, without doubt, are native to Alberta, even though it was formerly thought that their limit of distribution was hundreds of miles to the south.

It is probable that the range of the Black Widow Spider has always extended as far north as has that of such sedentary Arachnid relatives as scorpions and solpugids, and that our knowledge of its presence in Alberta is a direct result of the publicity which has been given to it in recent years. On the other hand, during the past two years, there have been two records from Medicine Hat of women having been bitten by these spiders. Neither case, fortunately, was fatal. There appear to be no earlier records of attacks by venomous spiders in Alberta, and this lends colour to the suggestion that the Black Widow Spider is a recent arrival which may not, as yet, have reached the limit of its possible distribution in the province. Another aspect of the problem is presented by a consideration of the normal source of food for these spiders. We have made no field observations on this in Alberta. In captivity they readily accept any species of fly which is offered to them, but Milzer, in an article in Science (1934), states that, in Colorado, their most frequent prey is the grasshopper, *Melanoplus bivittatus*. Since their apparent increase in Alberta has coincided with a severe outbreak of this grasshopper it is possible that, with the subsidence of this outbreak, the numbers of Black Widow Spiders will diminish even though their range of distribution may not be materially reduced.

E. H. STRICKLAND.
University of Alberta.

BOOK NOTICE.

Spider Wonders of Australia, by K. C. McKeown of the Australian Museum, Angus and Robertson, Publishers, Sydney, Australia. 270 pages, 33 photographs. Price 6/-.

This well-written book on Australian spiders presents in a very interesting manner, a wealth of information on this neglected group. The various methods employed by spiders to capture prey, such as the use of entangling webs, pursuit and capture by day or night, the use of web nets that are thrown, angling with a spun line and viscid bait, and the capture of birds and fish, are related in a fascinating manner. Cases of human deaths resulting from spider bites are discussed and attributed to but two spiders, the trap-door or funnel-web, and the redback of jockey spiders (the latter a near relative of the "black widow" occurring in parts of British Columbia). The chapters on "Courtship and Marriage" and "strange uses of spider web," hold the interest of the reader until their end.

Since representatives of several Australian genera of spiders are found in Canada, this book should be of interest to most nature lovers and help, in a small way at least, to foster interest in our Canadian species.

R. OZBURN.

NEWS AND VIEWS

AN AUTHENTIC CASE OF SCOLECIASIS

A case of human infestation by a lepidopterous larva, which is probably unique and worthy of record, was brought to the attention of the Dominion Entomologist by a local doctor of medicine on August 25, 1936. He reported to Dr. Gibson on the matter as follows: "Woman, age 58. Complaint—pain and itching in the vaginal orifice. On examination, urethral orifice found oedematous; three fair sized blibs, and what looked like a small mucous plug in the centre. On removing this plug it was found to be a worm, which was apparently blocking the urethral passage, because the urine followed freely." The doctor stated that the larva was alive when he removed it with a pair of forceps. It measured about five-eighths of an inch in length, and was tentatively identified as the European corn borer, *Pyrausta nubilalis* Hbn. This determination was later confirmed by G. M. Stirrett, officer in charge of the Dominion Entomological Laboratory, at Chatham, Ont., to whom the specimen was sent.

C. R. TWINN.

Entomological Branch, Ottawa, Ont.

EUROPEAN CORN BORER PUSHES FARTHER SOUTH, AND COMES THROUGH DRY SEASON SUCCESSFULLY

A recent press release from Washington, D. C., informs us that the European corn borer appeared this year, for the first time, on the mainland of Virginia—the farthest south it has ever gone. It is not known to have spread west of its previous boundary, however. The 1936 survey by the U. S. Department of Agriculture conducted solely to determine the economic status of the pest revealed that the corn borer has more than held its own throughout this territory as a whole, despite marked decreases from the drought in western New York and in large areas in Michigan, Ohio, and Indiana.

The number of borers, the survey showed, increased significantly in the border States—a danger sign of possible spread beyond the present territory if next season is favorable for its development.

The fact that the corn borer, which demands plenty of moisture for best development, came through a dry season so successfully and is now concentrated along the outer edges of the infested area shows the need for control measures this fall says L. A. Strong, Chief of the Bureau of Entomology and Plant Quarantine.

Mailed Saturday, January 2nd, 1937.

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